A NEW STATE RECORD FOR *POLYPHYLLA* AND ITS ZOOGEOGRAPHIC IMPLICATIONS (SCARABAEIDAE: MELOLONTHINAE)

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ABSTRACT

Polyphylla Harris is first recorded from Wisconsin, represented by *P. hammondi* LeConte. The deme sampled is geographically disjunct from the continuous species range and is recorded from an environmental refugium in an area commonly called the Wisconsin Desert. On the bases of this new record and 4 other relict *hammondi* demes, it is proposed that this species 1) invaded as far east as Wisconsin via the Pliocene Steppe, 2) retreated during the Pleistocene, 3) secondarily invaded eastwards via the postglacial xerothermic prairie peninsula and, 4) secondarily retreated westwards in response to destruction of the xerothermic prairie leaving western relict demes in unique eastern environmental refugia.

INTRODUCTION

Through the courtesy of K. I. Lange, Park Naturalist, Devil's Lake State Park, Wisconsin, I was recently able to determine an avittate male *Polyphylla hammondi* LeConte, collected in Wisconsin. The data associated with this specimen, which constitutes the first record of the genus in Wisconsin, are as follows: WISCONSIN: SW Sauk County, ca. 1 mi. N. Spring Green, 9-VII-71, K. I. Lange and F. J. Rich, captured at dusk emerging from burrow.

Lange (personal communication) also collected several other specimens on the evening of July 9 as they flew into the light of a Coleman lantern. This area, sometimes termed the Wisconsin desert, is within the flood plain of the Wisconsin River. Sandy terraces are composed of both shifting sand blows and dunes and areas of relatively stabilized sand. This unique habitat extends inland, away from the river valley until terminated by abrupt, limey bluffs. Lange also recorded 2 other insect species endemic to this area of Wisconsin: the cicada, *Diceroprocta vitripennis* (det. T. E. Moore), and the cicindelid beetle, *Megacephala virginica* (det. J. Lawton).

The distribution of *P. hammondi* in America north of Mexico, based on 1,451 specimens, shows a pattern (Fig. 1) of relatively continuous occurrence throughout the central and southwestern states. Four geographically disjunct demes are recorded, however: 1) Anoka Co., Minnesota (Fridley Sand Dunes), 2) Mason Co. (Havannah) and 3) Union Co. (Reynoldsville), Illinois, and 4) Posey Co., Indiana. The new state record presented here represents the fifth known disjunct deme for the species *hammondi*. In all cases, there is an exact correlation between the existence of these geographically isolated demes, and the unique presence of well-drained sandy soils or actual sand dune areas.

Discussion

When conspecific populations are geographically disjunct it is assumed that either (a) the species is actively colonizing new areas or (b) the species once had a broader range encompassing the sites of the now disjunct demes. As all the disjunct *hammondi* demes are found in similar sandy refugia uniquely suited to their survival, it seems most probable that they do represent geographical relicts rather than new colonies. The probability of such colonies being established in several widely separated but ecologically similar areas is surely very low. The following historical sequence is proposed to explain the existence of these disjunct demes: 1) Original invasion as far east as Wisconsin via the dry Pliocene Steppe. 2) Retreat westwards and southwards in response to the environmental rigors of the Pleistocene. 3) Secondary invasion as far east as Wisconsin via the postglacial xerothermic prairie peninsula. 4) Secondary retreat westwards in response to destruction of the xerothermic prairie, with western relicts left in eastern environmental refugia.

Late Pliocene uplift of the Sierra Nevada-Cascade and Peninsular ranges of southern California furnished a new barrier for incoming moisture. The rain shadow effect produced by this orogeny, along with a general uplift

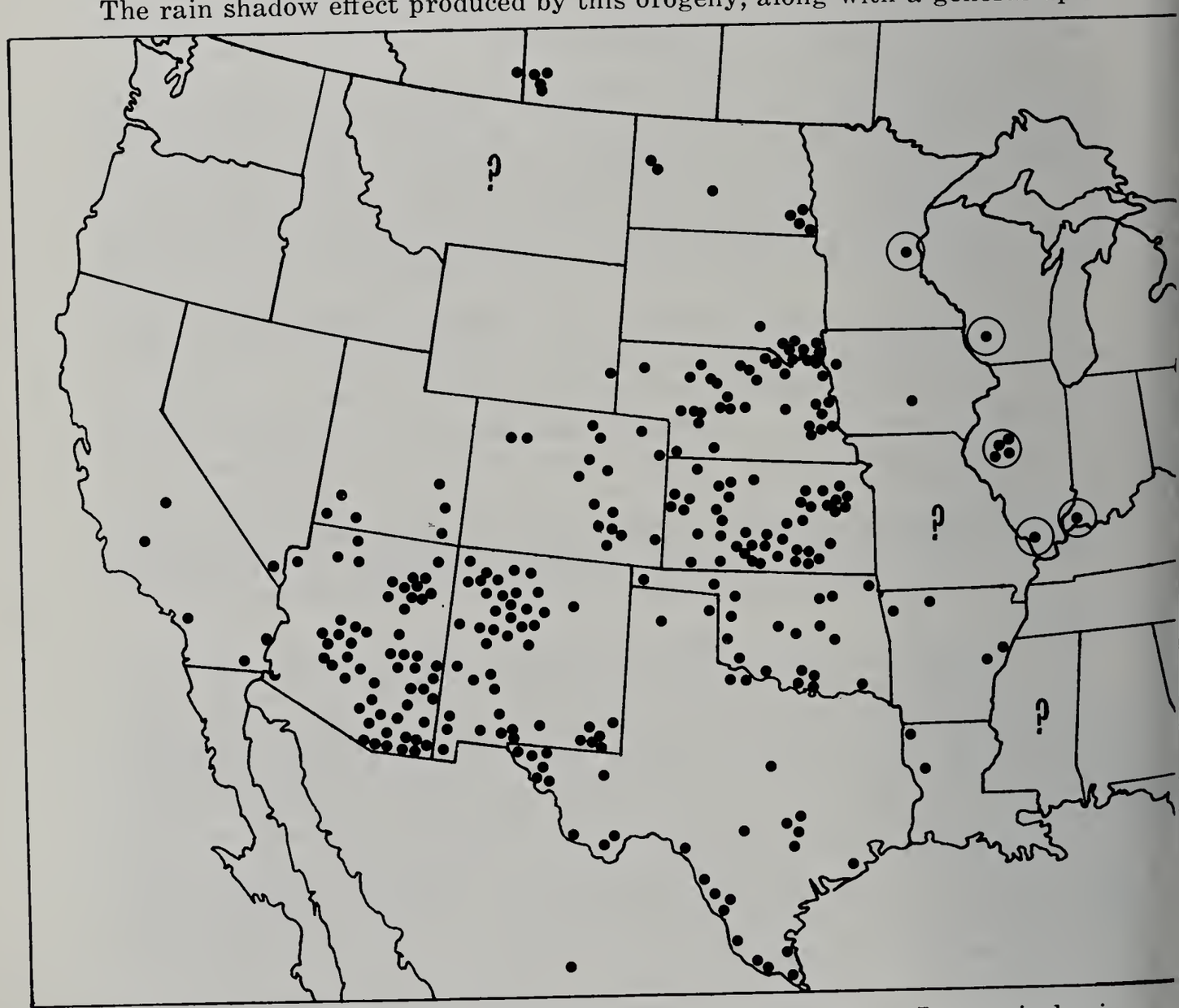

Fig. 1. Distribution of *Polyphylla hammondi* LeConte. Large circles indicate disjunct demes; question marks indicate state record with no additional data.

of the interior plains caused the drier environment which in turn caused the major decline of forests and eastwards expansion of the grasslands recorded in the Pliocene (Dodson, 1960). This middle Pliocene grassland steppe is offered as the most likely pathway by which elements of *hammondi*, and probably *Polyphylla* as a whole, first spread to the east, as outlined in step number 1 above.

It is quite well demonstrated in the literature (Howden 1963, 1966, and 1969) that many scarab groups were well established in midwestern and eastern North America before the Pleistocene. Some of the species we see today must have been isolated by then, with further fragmentation most likely caused by the rigors of the Pleistocene. It is proposed here that *hammondi* may be offered as a case in point, having been directly subjected to the Pleistocene environment of glaciers (Flint, 1957), pluvial conditions, and periglacial climates. Pleistocene glaciers physically covered the Minnesota and Illinois localities now hosting *hammondi*, while the Indiana and Wisconsin sites were ice free but subject to severe periglacial climates (Flint, 1957). These environmental factors are the most probable causative agents explaining the considerable westwards retreat of the range of *hammondi* outlined in step 2 above.

If all or any of the more eastern demes were forced westward and southward during the Pleistocene, postglacial reinvasion of the east had to take place. Postglacial climatic and vegetational chronologies offer the environmental matrix for this to have been possible. With the retreat of the ice, pollen records show the concurrent retreat of a belt of tundra parallel to the ice front (Smith, 1957). Other records of spruce-fir (cool wet), oak-hemlock (warm wet), and oak-hickory (warm dry) zones, indicate a cool-warm postglacial climatic sequence (Deevey, 1949). This postglacial warming trend, which peaked during the Xerothermic, caused a decline in mesic forests and their replacement by a drier oak-hickory grasslands complex (Elias, 1942). This phase, now well known as the prairie peninsula, allowed *hammondi* to reinvade the east, as proposed in step 3 above.

During the final climatic stabilization at the close of the Xerothermic, cooler moister conditions returned to much of eastern North America (creating a cool-warm-cool postglacial sequence), accompanied by an encroachment of mesic forest onto the more xeric steppe or grasslands (Smith, 1957). As the great mass of the eastern steppe was destroyed, animal species living there were forced to 1) retreat to the west from where many of them originally came, 2) adapt, or 3) be subject to extinction. As Figure 1 shows, the majority of *hammondi* demes were unable to survive, except for those relicts we see today in Minnesota, Illinois, Indiana, and Wisconsin. This reinvasion of the mesic forest is offered as the primary causative agent for step 4 above, with relict *hammondi* demes surviving only where the drier prairie peninsula habitat survived.

This phenomenon of western relicts displaced east of the species main range via these post-glacial environmental fluctuations is repeated in many species of animals, especially amphibians and reptiles (Smith, 1957; Schmidt, 1958). The pattern shown by *hammondi* is in fact, nearly the same as that shown by the hog-nosed snake, *Heterodon nasicus*, with a relict deme found in the identical sandy refugium at Havana, Illinois (Smith, 1957).

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BOOK REVIEW

The beetles of the Pacific Northwest. Part V. *Rhipiceroidea, Sternoxi, Phytophaga, Rhyncophora,* and *Lamellicornia,* by Melville H. Hatch. Jan., 1972. University of Washington Press, Seattle, Wash. 650p; 687 fig. Cloth $20.00

With the completion of this monumental series, the year 1972 is bound to be a banner year for Coleopterists, even if nothing else significant transpires. There have been extensive local or faunal studies in Europe for many years, but we have had notably few (e.g., Blatchley's "Coleoptera of Indiana", 1910) such works in this country. Dr. Hatch has devoted a lifetime of study and dedicated effort in completing this 5-volume set which started in 1953. It is certainly not necessary to enumerate the problems involved in such a pretentious task as to present a faunal treatment of the largest order in the animal kingdom and in a geographic area as large as British Columbia, Washington, Oregon, and Idaho. The 19 years between the first and last volumes undoubtedly have been filled with many hours of the "midnight oil" for Dr. Hatch and his collaborators.

At the beginning of the series Dr. Hatch estimated that 3,000 species would be involved—the kind of number which has dissuaded most workers who would contemplate such regional faunas. In the final analysis there